

WHAT IS CLAIMED IS:

1. An optical switching device having a plurality of input ports, and a plurality of output ports, the optical switching device comprising:

a plurality of circulators each having a plurality of ports while operating to output an optical signal, inputted to a higher-order port thereof, to a lower-order port thereof arranged adjacent to the higher-order port, each of the circulators being connected at a highest-order port thereof to an associated one of the input ports, at a lowest-order port thereof to an associated one of the output ports, and at each intermediate port thereof to a corresponding intermediate port of another one of the circulators; and

a plurality of reflectors each adapted to reflect an optical signal, inputted thereto, or to allow the optical signal to pass there through, each of the reflectors being connected between two intermediate ports of every two of the circulators connected to each other at the two intermediate ports,

wherein an optical signal input to an associated one of the input ports is output to an associated one of the output ports via at least one of the circulators.

2. The optical switching device according to claim 1, wherein each of the reflectors is a wavelength-independent bi-lateral reflector.

3. The optical switching device according to claim 1, wherein each of the reflectors is a wavelength-dependent optical grating.

4. The optical switching device according to claim 1, wherein each of the circulator as four or more ports.

5. The optical switching device according to claim 1, wherein each of the
5 circulators are aligned vertically.

6. The optical switching device according to claim 1, wherein said device being adapted for operation by a controller, wherein said controller independently controls each respective reflector of the plurality of reflectors on to reflect, or off to allow the passage of
10 light there through, according to a desired path.

7. The optical switching device according to claim 6, wherein said controller is programmed with a plurality of paths through said optical switch to permit passage from a particular input port to a particular output port.

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8. A method for optical switching using only circulators and reflectors, said method comprising the steps of:

(a) arranging, 2^n circulators, each circulator having at least $n+2$ ports such that they are vertically aligned with one another;

20 (b) connecting the first port of the p -th circulator input port, whereas the “ $n+2$ ”-th port of the p -th circulator is connected to the p -th output port;

(c) performing a primary division for the vertically-aligned circulators, so as to virtually divide the circulators into two groups;

(d) performing a division for two groups of the circulators, respectively, so as to virtually divide each of the two groups into m -th groups; and

5 (e) interposing a reflector between two ports of every two of the circulators connected to each other.

9. The method according to claim 8, wherein step (b) is repeated from $p=1$ to $p=2^n$.

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10. The method according to claim 8, wherein step (d) further comprises:

virtually dividing each of the two groups into " $m-1$ "-th upper and lower groups and into m -th upper and lower groups, and connecting the " $n+2-m$ "-th port of each circulator in each m -th upper group to the " $n+2-m$ "-th port of a circulator in the associated m -th lower group having the same order as that of the circulator in the m -th upper group; and

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11. The method according to claim 10, wherein step (d) is repeatedly performed from $m=2$ to $m=n$.

20 12. The method according to claim 8, wherein step (c) includes that the two groups comprise primary upper and primary lower groups.

13. The method according to claim 11 wherein the " $n+1$ "-th port of each circulator

in the primary upper group is connected to the “n+1”-th port of a circulator in the primary lower group having the same order as that of the circulator in the primary upper group.

14. The method according to claim 8, further comprising:

providing a controller to control the on/off status of the reflectors in step (e) so that
5 in an off state said reflector allows an optical signal to pass there through.

15. The method according to claim 14, wherein said controller contains a plurality of paths from a respective input port to a respective output port, and controls the on/off status of the reflectors in accordance therewith.

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